Coral Bleaching and Light Attenuation: Can Elevated Turbidity Help Corals?

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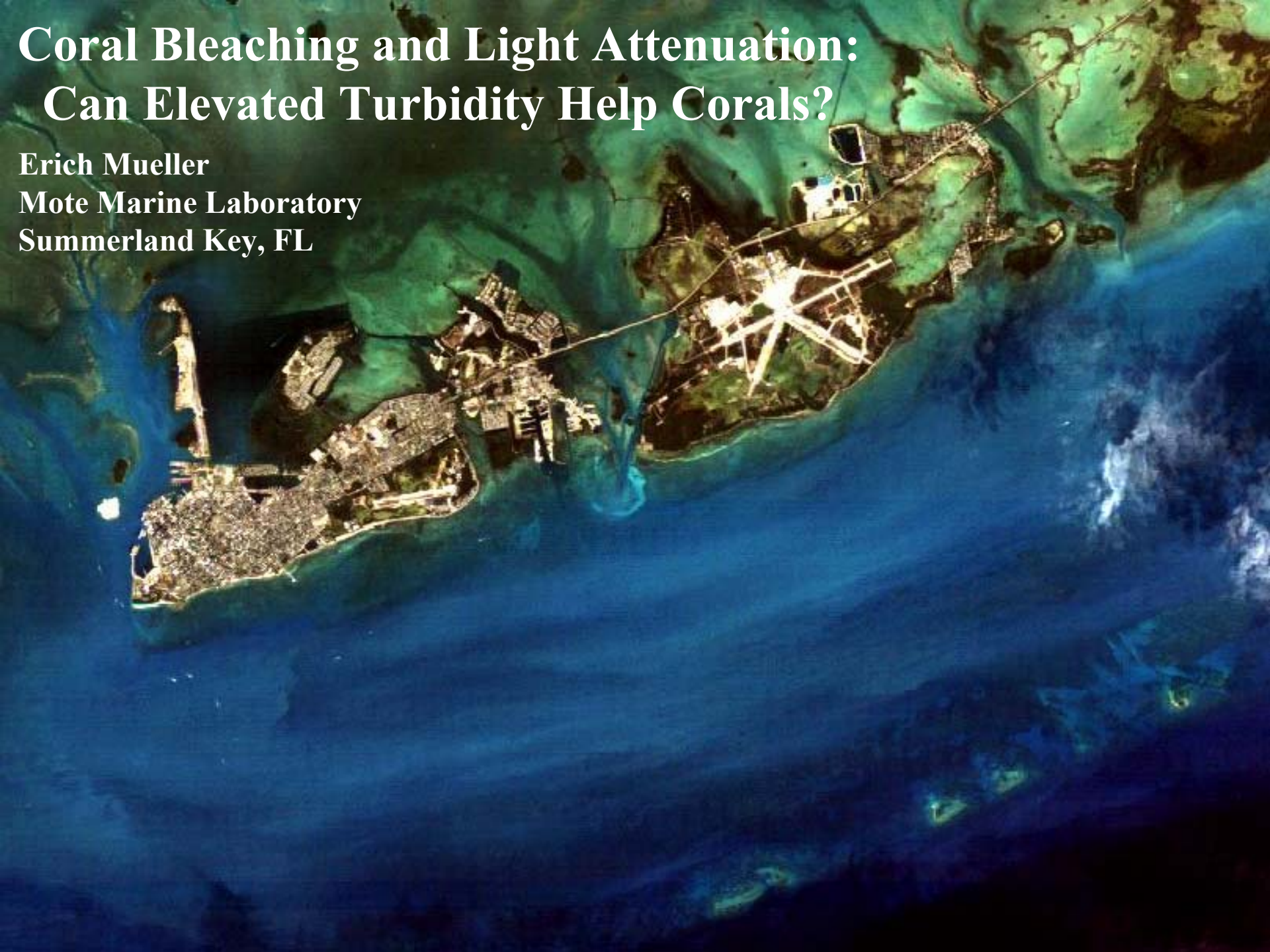
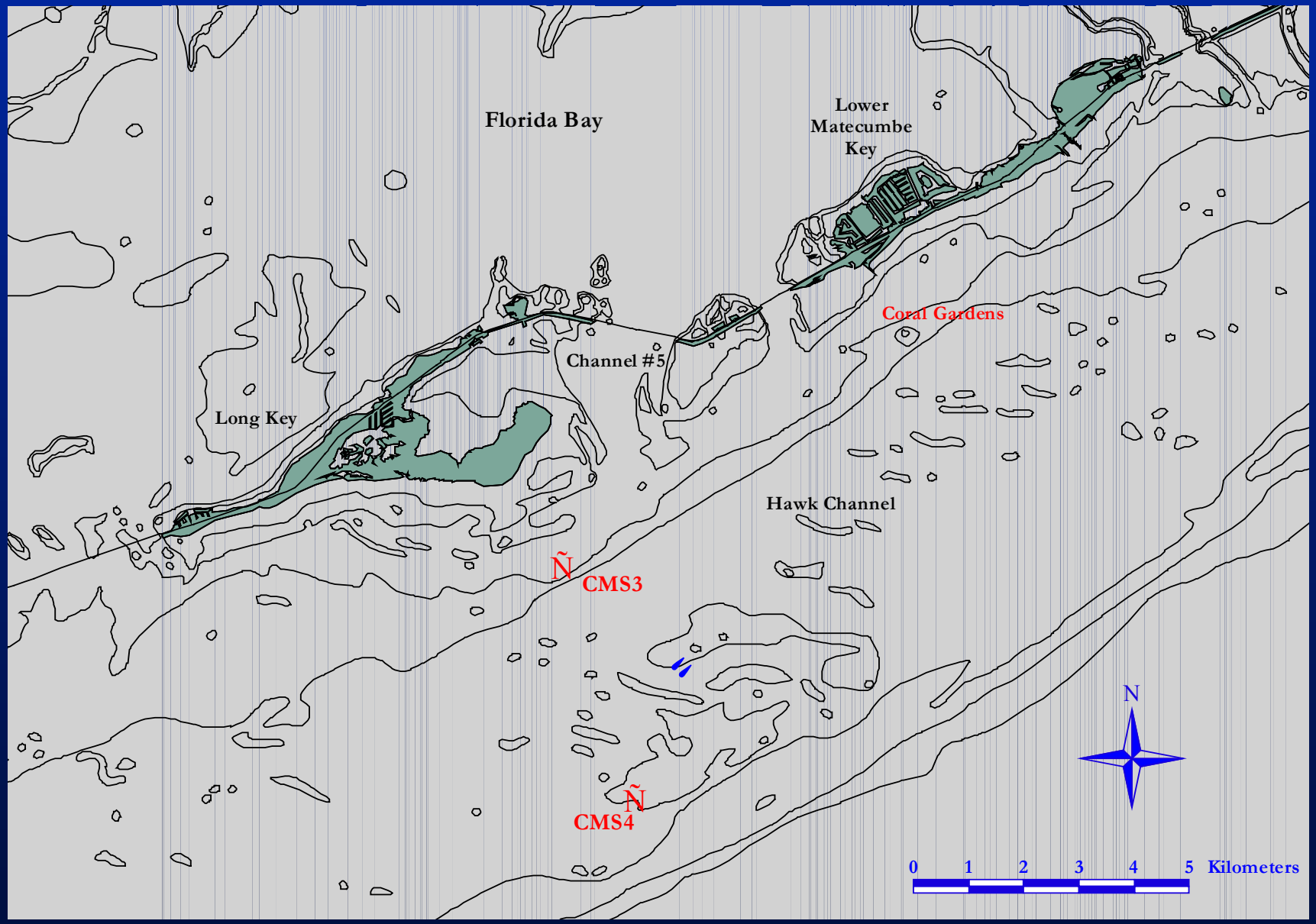
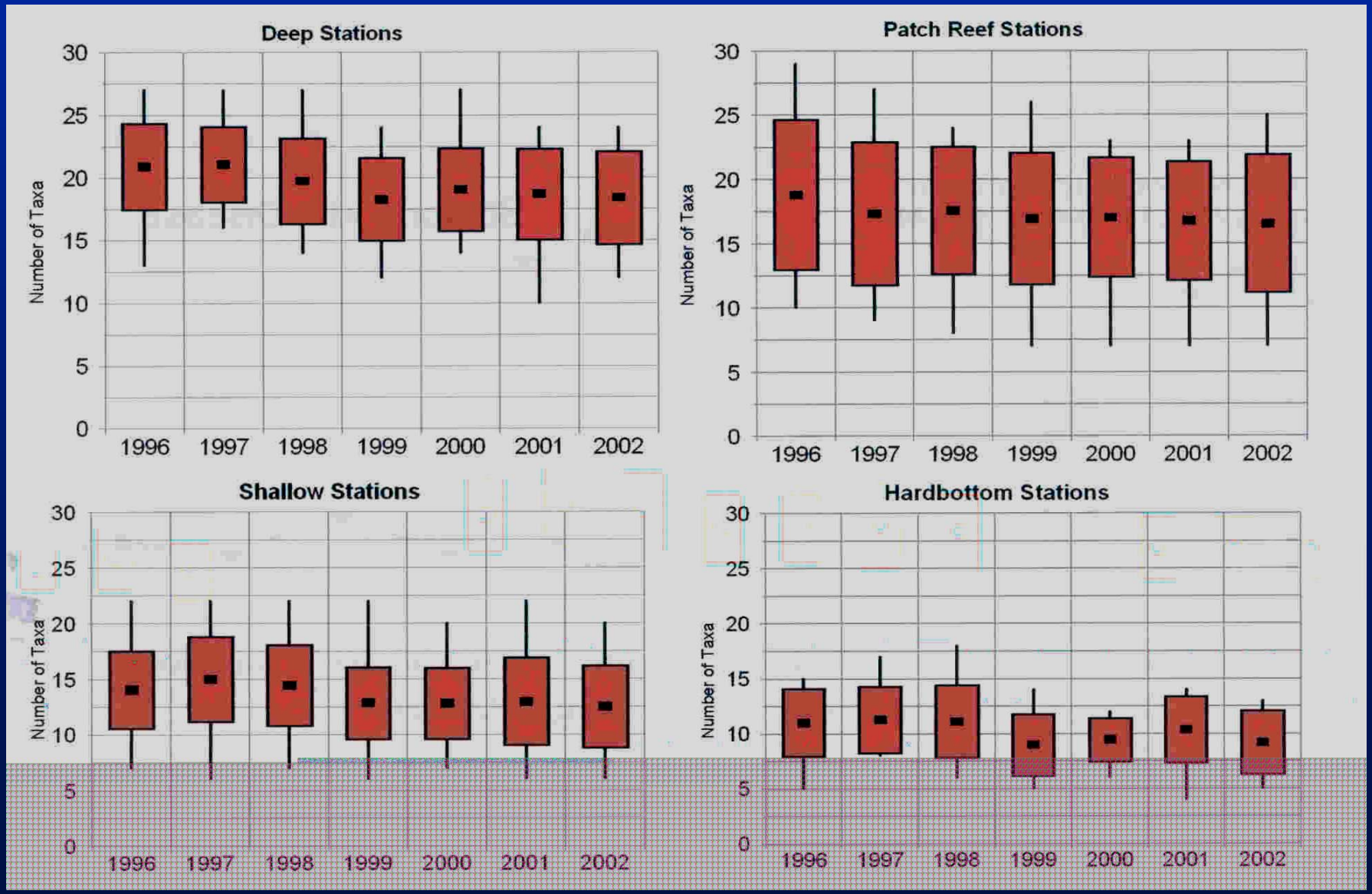




Cook, Clayton B., Erich M. Mueller, M. Drew Ferrier and Eric Annis, 2001. The influence of nearshore waters on corals of the Florida Reef Tract. In: *The Everglades, Florida Bay, and Coral Reefs of the Florida Keys: An Ecosystem Sourcebook*. eds. J.W. Porter and K.G. Porter. CRC Press, Boca Raton, FL, 771-788.

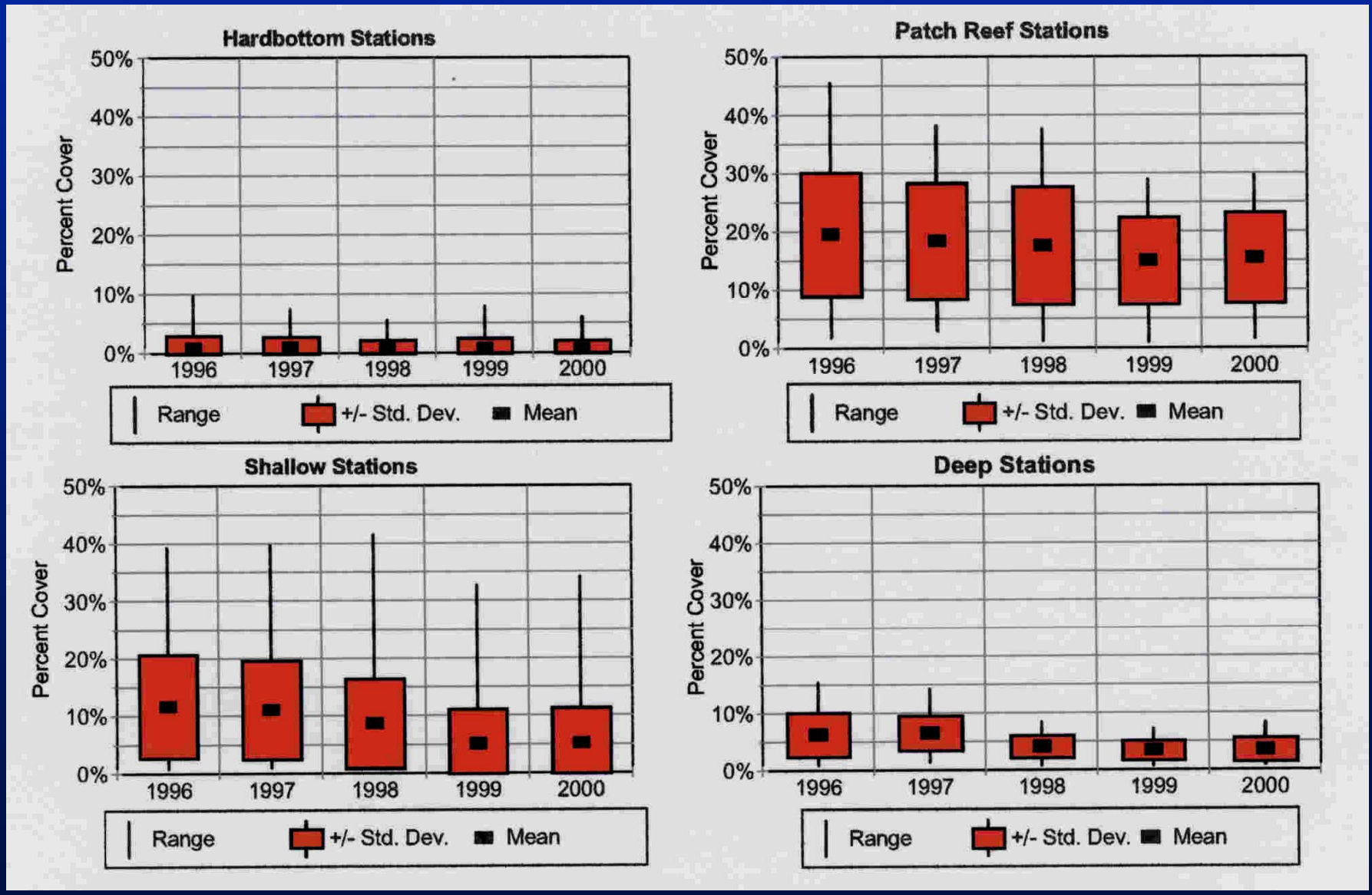
Measured Parameters

A. coral growth	
1. $CaCO_3$ accretion - buoyant weight	higher offshore
2. vertical extension - alizarin red S	no site differences
3. areal extension - foil method	no site differences
4. corallite counts	higher density offshore
B. nutrient status	
1. zooxanthellae density	no site differences
2. chl *a* and c_2 per cell	chl *a* higher inshore
3. C:N:P ratios	>P limitation inshore
4. NH_4^+-enhancement of dark C fixation	higher inshore
5. basic:total free amino acid ratios	no site differences
6. Gln:Glu ratios	no site differences
7. photosynthetic rates	higher offshore



Mean stony coral species number by habitat. 1996-2002.

Coral Reef Monitoring Project, Update to 2000 Executive Summary.



Mean percent stony coral cover by habitat. 160 stations, 1996-2000.

Coral Reef Monitoring Project, 2000 Executive Summary.

So why are reefs in the chronically turbid Hawk Channel apparently in better condition than nearby bank reefs?

1. Reduced visitor use?
2. Adaptive host characteristics?
3. Adaptive zooxanthellae characteristics?
4. Moderated temperature?
5. Reduced visible radiation (PAR)?
6. Reduced UV radiation?
7. Combinations of the above?

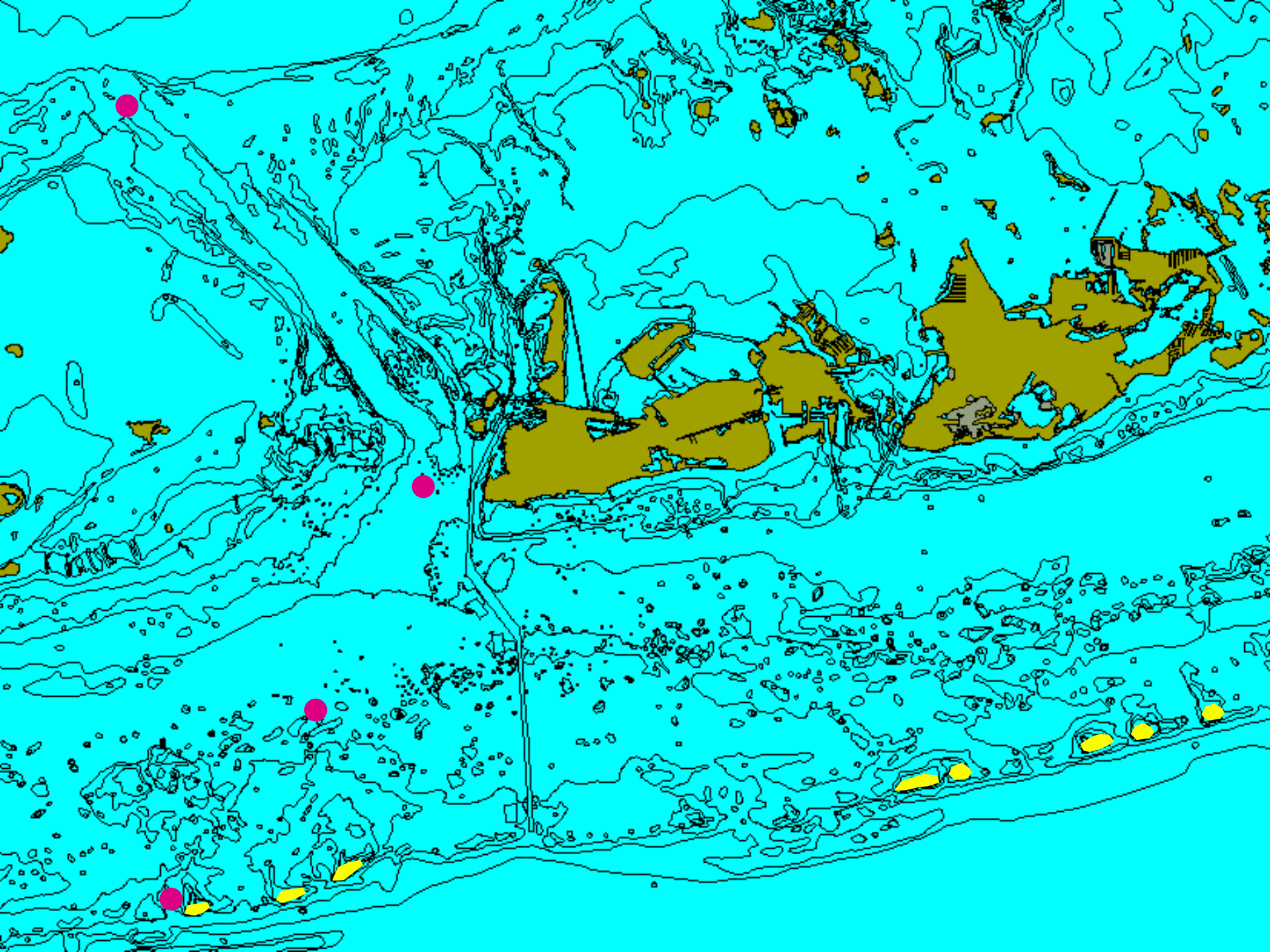
Proposed Three-Component Approach

I. Characterize & model physical environment.

II. Characterize spatial and temporal variability in a model coral species.

III. Experimentally examine coral responses to changes in the physical environment.


NW Channel
Key West
Hawk Channel patch
Sand Key



Component I

In situ instrumentation

- suspended particles: LIIST
- PAR: downwelling, 2 depths; upwelling 1 depth
- UV: downwelling, 2 depths
- current: ADCP
- temperature & salinity: CTD
- sediment traps

Other automated data sources

- sea level (Key West tide stations)
- meteorological data (Sand Key; Key West)
- atmospheric UV (Summerland Key)

Component I

Quarterly water sampling

- inorganic particulates
- particulate organic material (POM)
- absorption spectra (chlorophyll & others)
- chromophoric dissolved organic matter (CDOM)

Other periodic data sources

- N and P (quarterly; WQMP)
- silicate & others (quarterly; WQMP)
- coral cover & species (annual; CRMP)

Component II

Coral Parameters

M. annularis forma *faveolata*

- 4 replicate colonies / site
- condition (quarterly)
- host protein (quarterly)
- zooxanthellae biomass (quarterly)
- photosynthetic performance (PAM; quarterly)
- zooxanthellae population genetics (semi-annually)
- coral growth (calcification & extension; annual study period)

Component III

Reciprocal Transplant Experiments

- 4 paired sites
- 4 replicate colonies/site (8 m)
- treatments
  - offshore (8 m)
    1. control (UVT acrylic)
    2. light attenuated (UVT acrylic + ND density filter)
    3. UV attenuated (UVT + Mylar filter)
    4. light + UV attenuated (UVT + UV filter + ND filter)
  - inshore
    1-4. above at irradiance depth equivalent to offshore)
    5. control (8 m)

Component III

Measured Responses

- growth
- host & symbiont biomass
- photosynthetic performance
- zooxanthellae population genetics
- stress biomarker suite